PROCESS CARTRIDGE AND ELECTROPHOTOGRAPHIC IMAGE FORMING APPARATUS

FIELD OF THE INVENTION AND RELATED ART:

The present invention relates to a process cartridge and an electrophotographic image forming apparatus to which the process cartridge is demountably mounted.

Here, the electrophotographic image forming apparatus is an apparatus for forming the image on a recording material (recording sheet, OHP sheet or the like) through an electrophotographic image forming process. It includes an electrophotographic copying machine, electrophotographic printer or the like.

The process cartridge is a cartridge containing as a unit an electrophotographic photosensitive member and process means including at least one of charging member and developing member, which cartridge is detachably mountable to a main assembly of the electrophotographic image forming apparatus.

With the electrophotographic image forming apparatus of the process cartridge type, the process cartridge can be mounted to or demounted from the main assembly of the image forming apparatus by the user without an expert serviceman. Therefore, the operationality of the image forming apparatus is

remarkably improved.

In such an electrophotographic image forming apparatus, it is necessary to supply electric voltages to a charging member for electrically charging the electrophotographic photosensitive member (photosensitive drum), a developing member for developing an electrostatic latent image formed on the photosensitive drum, and the like, which are contained in the process cartridge.

Heretofore, a provision of the cartridge is provided with an input electrical contact for electrical connection between the cartridge and the main assembly of the apparatus when the cartridge is mounted in place in the main assembly of the image forming apparatus. On the other hand, the main assembly of the apparatus is provided with an output contact. With this structure, when the cartridge is mounted to the main assembly of the apparatus, the input electrical contact is connected with the output contact. By doing so, the voltage can be supplied from the main assembly of the apparatus to the cartridge.

More particularly, the following structure is known.

A movable protection plate covering the contact member (the output contact) is provided in the main assembly of the apparatus. When the printer

(image forming apparatus) is subjected to a maintenance operation, the operator and/or a tool is prevented from touching the contact member. By inserting motion of the cartridge into the main assembly of the apparatus, the protection plate is retracted to a retracted position. By doing so, the electrical connection is permitted between the contact member in the main assembly of the apparatus and the contact member on the cartridge (input electrical contact) (paragraph s ([0012] -[0015], Figure 1 - Figure 3 of Japanese Laid-open Patent Application Hei 7- 77921).

When the unit is dismounted from the main assembly of the apparatus, a connector pin (output contact) is hidden inside a partition wall. By doing so, the serviceman or user is prevented from touching the connector pin. By the insertion of the unit into the main assembly of thc apparatus, the connector pin enters the unit insertion space. Thus, the connector pin and connector portion of the unit (input electrical contact) are electrically connected. (Page 4, bottom left Col., Line 15 to top left Col. Line 15, Figure 1A, Figure 1B, Figure 4A).

In addition, the drum shutter is provided with a regulating portion. The regulating portion is effective to cover the electrical contact (input electrical contact). By doing so, the contact defect

which may be caused by deposition of foreign matter on the electrical contact, can be prevented. By the entering of the cartridge into the main assembly of the apparatus, the electrical contact of the cartridge and the electrical contact of the main assembly of the apparatus (output contact) are electrically connected. ([0039] -[0047], Figure 17 of Japanese Laid-open Patent Application Hei 10- 74030).

A contact member (output contact) is provided and is movable between a retracted position and a regular position. By doing so, the contact portion of the cartridge (input electrical contact) and the contact member of the main assembly of the apparatus are contacted with each other in order. Before the cartridge is inserted into the main assembly of the apparatus, the contact member (output contact) is in the retracted position. When the cartridge is mounted to the main assembly of the apparatus, the contact member is moved to the regular position. By this, the contact portion and the contact portion are electrically connected with each other. ([0016] -[0029], Figure 1 - Figure 3 of Japanese Laid-open Patent Application Hei 9- 68833).

The present invention provides a further improvements in such structures.

SUMMARY OF THE INVENTION:

It is a principal object of the present invention to provide a process cartridge and an electrophotographic image forming apparatus wherein the reliability of electrical connection between an input electrical contact of a process cartridge and an output contact provided in a main assembly of an image forming apparatus when the process cartridge is mounted in the main assembly of the electrophotographic image forming apparatus.

It is another object of the present invention to provide a process cartridge and an electrophotographic image forming apparatus wherein damage of an electric circuit provided in the main assembly of the electrophotographic image forming apparatus can be prevented.

It is a further object of the present invention to provide a process cartridge and an electrophotographic image forming apparatus wherein an impact or shock on the process cartridge from the main assembly of the apparatus when the process cartridge is mounted to the mounting portion of the main assembly of the electrophotographic image forming apparatus, can be reduced.

It is a further object of the present invention to provide a process cartridge and an electrophotographic image forming apparatus wherein an output contact is moved from a retracted position to

an electrical connecting position by inserting the operation of the process cartridge into the main assembly of the electrophotographic image forming apparatus.

According to an aspect of the present invention, there is provided a process cartridge detachably mountable to a main assembly of an electrophotographic image forming apparatus, said main assembly including an output contact movable between an electrical connecting position and a retracted position retracted from the electrical connecting position, a displaceable member for moving the output contact, and an elastic function member for elastically urging the displaceable member to urge the output contact toward the retracted position away from the electrical connecting position, said process cartridge comprising an electrophotographic photosensitive drum; process means actable on said electrophotographic photosensitive drum; a movable operation member movable relative to a cartridge frame, wherein when said process cartridge is inserted into the main assembly of the apparatus, said movable operation member is engageable with a fixed engageable member fixed in the main assembly of the apparatus to move relative to the cartridge frame, and is engageable with a displaceable engaging portion of the displaceable member to move the output contact from

the retracted position to the electrical connecting position against an elastic force of the elastic function member, after the engagement with the fixed engageable member; an input electrical contact for receiving a voltage for enabling said process means by engagement with the output contact moved to the electrical connecting position.

These and other objects, features and advantages of the present invention will become more apparent upon a consideration of the following description of the preferred embodiments of the present invention taken in conjunction with the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS:

Figure 1 is a sectional view of the process cartridge according to an embodiment of the present invention.

Figure 2 illustrates a structure of an image forming apparatus according to an embodiment of the present invention.

Figure 3 is a perspective view of the image forming apparatus according to the embodiment of the present invention.

Figure 4 shows a mounting portion of the main assembly of the apparatus to accept the process cartridge according to the embodiment of the present

invention.

Figure 5 shows a mounting portion of the main assembly of the apparatus to accept the process cartridge according to the embodiment of the present invention.

Figure 6 is a perspective view of a process cartridge according to the embodiment of the present invention.

Figure 7 is a perspective view of a process cartridge according to the embodiment of the present invention.

Figure 8 illustrates a structure of a drum unit of the process cartridge in the embodiment of the present invention.

Figure 9 illustrates a structure of a movable operation member of the process cartridge according to the embodiment of the present invention.

Figure 10 figure 9 illustrates a structure of a movable operation member of the process cartridge according to the embodiment of the present invention.

Figure 11 illustrates a structure of an electrical contact portion provided in the main assembly of the image forming apparatus according to the embodiment of the present invention.

Figure 12 illustrates a structure of a mounting portion provided in the main assembly of the image forming apparatus according to the embodiment of

the present invention.

Figure 13 illustrates structures of the movable operation member and the electrical contact of the image forming apparatus according to the embodiment of the present invention.

Figure 14 illustrates structures of the movable operation member and the electrical contact of the image forming apparatus according to the embodiment of the present invention.

Figure 15 illustrates structures of the movable operation member and the electrical contact of the image forming apparatus according to the embodiment of the present invention.

Figure 16 illustrates a structure of a circuit board in the image forming apparatus according to the embodiment of the present invention.

Figure 17 illustrates a structure of a movable operation member of a process cartridge according to another embodiment of the present invention.

Figure 18 illustrates a structure of the movable operation member of the process cartridge according to the embodiment of the present invention.

Figure 19 illustrates a structure of the movable operation member of the process cartridge according to the embodiment of the present invention.

Figure 20 illustrates a structure of an

electrical contact portion in the main assembly of the image forming apparatus according to the embodiment of the present invention.

Figure 21 illustrates structures of the movable operation member and the electrical contact of the image forming apparatus.

Figure 22 illustrates structures of the movable operation member and the electrical contact of the image forming apparatus according to a further embodiment of the present invention.

Figure 23 illustrates structures of the movable operation member and the electrical contact of the image forming apparatus.

Figure 24 structures of the movable operation member and the electrical contact of the image forming apparatus according to the embodiment of the present invention.

Figure 25 illustrates structures of the movable operation member and the electrical contact of the image forming apparatus.

Figure 26 illustrates a structure of the movable operation member of the process cartridge according to a further embodiment of the present invention.

Figure 27 illustrates a structure of the drum unit in the embodiment of the present invention.

Figure 28 illustrates a structure of the

movable operation member of the process cartridge according to the embodiment of the present invention.

Figure 29 illustrates a structure of the movable operation member of the process cartridge according to the embodiment of the present invention.

Figure 30 illustrates a structure of the movable operation member of the process cartridge according to the embodiment of the present invention.

Figure 31 illustrates a structure of the movable operation member of the process cartridge according to the embodiment of the present invention.

Figure 32 illustrates a structure of the movable operation member of the process cartridge according to the embodiment of the present invention.

Figure 33 illustrates a structure of the movable operation member of the process cartridge according to the embodiment of the present invention.

Figure 34 illustrates a structure of the movable operation member of the process cartridge according to the embodiment of the present invention.

Figure 35 illustrates a structure of the movable operation member of the process cartridge according to the embodiment of the present invention.

Figure 36 illustrates a structure of the movable operation member of the process cartridge according to the embodiment of the present invention.

Figure 37 illustrates a structure of the

movable operation member of the process cartridge according to the embodiment of the present invention.

Figure 38 illustrates a structure of the movable operation member of the process cartridge according to the embodiment of the present invention.

Figure 39 illustrates a structure of the movable operation member of the process cartridge according to the embodiment of the present invention.

Figure 40 illustrates a structure of the movable operation member of the process cartridge according to the embodiment of the present invention.

Figure 41 illustrates a structure of an electrical contact portion in the main assembly of the image forming apparatus according to the embodiment of the present invention.

Figure 42 illustrates structures of the movable operation member and the electrical contact of the image forming apparatus.

Figure 43 illustrates structures of the movable operation member and the electrical contact of the image forming apparatus.

Figure 44 illustrates structures of the movable operation member and the electrical contact of the image forming apparatus.

Figure 45 illustrates a structure of the movable operation member of the process cartridge according to the embodiment of the present invention.

Figure 46 illustrates a structure of an electrical contact portion in the main assembly of the image forming apparatus according to the embodiment of the present invention.

Figure 47 illustrates a structure of an electrical contact portion in the main assembly of the image forming apparatus according to the embodiment of the present invention.

Figure 48 illustrates structures of the movable operation member and the electrical contact of the image forming apparatus.

Figure 49 illustrates structures of the movable operation member and the electrical contact according to the embodiment of the present invention.

Figure 50, (a) illustrates a structure of the electrical contact portion in the main assembly of the image forming apparatus according to the embodiment of the present invention.

Figure 50, (b) illustrates a structure of the electrical contact portion in the main assembly of the image forming apparatus according to the embodiment of the present invention.

Figure 51 is views of a displaceable member and an output contact member in the image forming apparatus according to the embodiment of the present invention as seen from the outside of the outer plate.

Figure 52, (a) illustrates a structure of the

mounting portion of the output contact member in the image forming apparatus according to the embodiment of the present invention.

Figure 52, (b) illustrates a structure of the mounting portion of the output contact member in the image forming apparatus according to the embodiment of the present invention.

Figure 53, (a) is a perspective view illustrating a relation between the input electrical contact member of the process cartridge and the displaceable member and the output contact member which are provided in the main assembly of the image forming apparatus.

Figure 53, (b) is a front view illustrating a relation between the input electrical contact member of the process cartridge and the displaceable member and the output contact member which are provided in the main assembly of the image forming apparatus.

Figure 53, (c) is a front view illustrating a relation between the input electrical contact member of the process cartridge and the displaceable member and the output contact member which are provided in the main assembly of the image forming apparatus.

DESCRIPTION OF THE PREFERRED EMBODIMENTS:

The description will be made as to the embodiments of the process cartridge and the

electrophotographic image forming apparatus according to the present invention.

Embodiment 1

(1) General Structure of Process Cartridge

Referring to Figure 1, a process cartridge B (cartridge) according to a first embodiment of the present invention will be described. Figure 1 is a sectional view of the cartridge B.

In Figure 1, the cartridge B comprises an electrophotographic photosensitive drum (photosensitive drum) 107. As shown in Figure 2, when the cartridge B is mounted to the main assembly A of the electrophotographic image forming apparatus (main assembly of the apparatus), the photosensitive drum 107 is rotatable by receiving a driving force from the main assembly A.

Disposed opposed to an outer surface of the photosensitive drum 107 is a charging roller 108 functioning as a charging member. The charging roller 108 is supplied with a voltage from the main assembly A of the apparatus and electrically charges the photosensitive drum 107. The charging roller 108 is contacted to the photosensitive drum 107 and is rotated by the photosensitive drum 107.

When the cartridge B is mounted to the main assembly A of the apparatus, the charging roller 108

is supplied with a voltage from the main assembly 100 of the apparatus through a charging output contact 144a (Figure 4) functioning as an output contact and a charging input electrical contact 141a (Figure 10) functioning as an input electrical contact. The charging roller 108 functions by the voltage to electrically charge the photosensitive drum 107.

The cartridge B includes a developing roller 110 functioning as a developing member. The developing roller 110 supplies the developer t into a developing zone adjacent a photosensitive drum 107. The developing roller 110 develops an electrostatic latent image formed on the photosensitive drum 107 with the dcveloper t. The developing roller 110 contains a magnet roller (stationary magnet) 111.

When the cartridge B is mounted to the main assembly A of the apparatus, the developing roller 110 is supplied with a voltage from the main assembly 100 of the apparatus through a development output contact 161a (Figure 41) functioning as an output contact and a development input electrical contact 160a (Figure 40) functioning as an input electrical contact. The developing roller 110 functions by the thus applied voltage to develop the electrostatic latent image.

To the peripheral surface of the developing roller 110, a developing blade 112 is contacted. The developing blade 112 functions to regulate an amount

of the developer t deposited on the peripheral surface of the developing roller 110. The developing blade 112 also functions to triboelectrically charge the developer t.

The developer t accommodated in the developer accommodating container 114 is supplied out into the developer chamber 113a by rotation of the stirring members 115, 116. The developing roller 110 supplied with the voltage through the electrical contact 160a is rotated. By doing so, a layer of the developer having the triboelectric charge applied by the developing blade 112 is formed on the surface of the developing roller 110. The developer t is transferred onto the photosensitive drum 107 in accordance with the pattern of the latent image. Thus, the latent image developed.

The developed image on the photosensitive drum 107 is transferred onto a recording material 102 by a transfer roller 104.

Disposed opposed to the outer surface of the photosensitive drum 107 is an elastic cleaning blade 117a. The cleaning blade 117a has an edge which is contacted to the photosensitive drum 107. The blade 117a functions to remove the developer t remaining on the photosensitive drum 107 after transfer of the developed image onto the recording material 102. The developer t removed from the surface of the

photosensitive drum 107 by the blade 117a is accommodated in a removed developer container 117b.

The cartridge B is constituted integrally by the developing unit 119 and the drum unit 120.

The developing unit 119 is constituted by the developing device frame 113 which is a part of the cartridge frame B1. The developing unit 119 contains the developing roller 110, the developing blade 112, the developer chamber 113a, the developer accommodating container 114 and stirring members 115, 116. A development input electrical contact 160a id provided exposed from the developing device frame 113.

A drum unit 120 is constituted by a drum frame 118 which is a part of the cartridge frame B1. The drum unit 120 contains the photosensitive drum 107, the cleaning blade 117a, the removed developer container 117b and the charging roller 108. The charging input electrical contact 141a is provided exposed from the drum frame 118. The electrical contact 141a is disposed at a lower part of the drum frame 118. More particularly, the electrical contact 141a is disposed at such a position as is a lower part of the drum frame 118 when the cartridge B is placed in the main assembly A of the apparatus.

One end of the photosensitive drum 107 is supported by the drum frame 118. An outer end of the drum shaft 139 functions as a cartridge guide 140L1

which will be described hereinafter referring to Figure 7.

As will be understood from Figure 6, cartridge guides 140R1, 140R2 are provided at one longitudinal end 120a of the drum unit 120. As shown in Figure 7, a cartridge guide 140L1 and another cartridge guide 140L2 are provided at the other longitudinal end 120b.

The developing unit 119 and the drum unit 120 are rotatably coupled with each other by pins P. The developing roller 110 is urged to the photosensitive drum 107 by an elastic member (unshown) which is provided between the units 119, 120. Designated by 119a is an arm which is provided in the developing unit 119. The arm 119a is engaged with the drum unit 120, and the pin P are set in the holes formed in the units 119, 120.

(2) Electrophotographic Image Forming Apparatus

Referring to Figure 2, the description will be made as to the electrophotographic image forming apparatus 100 with which the cartridge B is usable. Figure 2 shows a general arrangement of an electrophotographic image forming apparatus (image forming apparatus) 100.

The description will be made as to a laser beam printer which is an exemplary image forming apparatus 100.

In the image forming operation, a surface of the photosensitive drum 107 is uniformly charged by the charging roller 108. A laser beam is emitted from a laser diode and is projected onto the photosensitive drum 107 in accordance with image information with optical means 101 including a polygonal mirror, lenses and deflection mirrors (unshown). By doing so, an elcctrostatic latent image is formed on the photosensitive drum 107 corresponding to the image information. The latent image is developed by the developing roller 110 which has been described hereinbefore.

On the other hand, in synchronism with the formation of the developcd image, a recording material 102 in a cassette 103a is fed out by pick-up roller 103b and is fed to a transfer position by feeding rollers 103c, 103d, 103e. At the transfer position, a transfer roller 104 (transferring means) is provided. The transfer roller 104 is supplied with a voltage. By this, the developed image formed on the photosensitive drum 107 is transferred onto the recording material 102.

The recording material 102 now having the devcloped image transferred thereto is fed to fixing means 105 through a guide 103f. The fixing means 105 includes a driving roller 105c and a fixing roller 105b containing a heater 105a therein. The fixing

means 105 applies heat and pressure to the recording material 102 passing therethrough to fix the developed image on the recording material 102. The recording material 102 is fed by a pair of rollers 103g and 103g onto a tray 106. The roller 103b, the pair of feeding rollers 103c, 103d, 103e, the guide 103f, the pair of rollers 103g, 103h and so on constitute feeding means 103 for the recording material 102.

The cartridge B is mounted into or demounted from the main assembly A of the apparatus in the following manner.

As shown in Figure 3, the operator opens a door 109 provided in the main assembly A of the apparatus. The cartridge B is dcmountably mounted to cartridge mounting means 130 provided in the main assembly A of the apparatus.

As shown in Figure s 4 and 5, the mounting means 130 of this embodiment includes main assembly guides 130R1, 130R2, 130L1, 130L2 in the main assembly A of the apparatus. When the cartridge B is mounted to the main assembly A of the apparatus, it is inserted toward the cartridge mounting portion 130a such that cartridge guides 140R1, 140R2 (Figure 6) are guided by the main assembly guides 130R1, 130R2, and the cartridge guides 140L1, 140L2 (Figure 7) are guided by the main assembly guides 130L1, 130L2.

The cartridge guide 140R1 is engaged with the

positioning portion 130R1a of the main assembly guide 130R1, and the cartridge guide 140R2 is abutted to the positioning portion 130R2a of the main assembly guide 130R2; and the cartridge guide 140L1 is engaged with the positioning portion 130L1a of the main assembly guide 130L1, and the cartridge guide 140L2 is abutted to the positioning portion 130L2a of the main assembly guide 130L2. At this time, the cartridge B is demountably mounted to the cartridge mounting portion 130a by the mounting means 130. By the cartridge B mounted in place in the cartridge mounting portion 130a, the image forming operation is enabled. Here, the cartridge mounting portion 130a is the space occupied by the cartridge B which is mounted in place to the main assembly A of the apparatus by the mounting means 130.

When the cartridge B is mounted, a coupling 134 (Figure 5) functioning as a driving force transmitting portion is at a retracted position, so that it does not interfere with the cartridge B which is being inserted for mounting. When the cover 109 is closed, the coupling 134 provided in the main assembly A of the apparatus is brought into engagement with a coupling 107a (Figure 6) of the coupling 107a of the cartridge B functioning as a driving force receiving portion. Then, the process cartridge is capable of receiving a driving force for rotating the

photosensitive drum 107 from the main assembly A of the apparatus. As described in the foregoing, the electrophotographic image forming apparatus 100 comprises a main assembly A and a process cartridge B demountably mounted to the main assembly A.

(3) Charging Input Electrical Contact Member of Cartridge B

The description will be made as to an input electrical contact member 141, provided in the cartridge B, for receiving a voltage for charging the photosensitive member.

Figure 8 is a perspective view wherein a side of the drum frame 118 has been removed so that inside of the drum frame 118 can be seen. Figure 10, (a) and (b) are side views of the cartridge B.

As shown in Figure s 8, 10, (a) and (b), the drum unit 120 is provided with the input electrical contact member (input electrical contact member) 141 for receiving a charging voltage to be supplied to the charging roller 108 from the main assembly A of the apparatus (charging input electrical contact member). The input electrical contact member 141 is mounting on the drum frame 118. A charging input electrical contact (input electrical contact) 141a which is a part of input electrical contact member 141 is provided on a side surface 120b1 at the other longitudinal (longitudinal direction of the drum 107)

end 120b of the drum frame 118 (Figure 7), and is exposed there.

More particularly, the input electrical contact 141a is disposed at a position downstream of the drum shaft 139 with respect to a direction X in which the cartridge B is inserted into the main assembly A of the apparatus. The input electrical contact member 141 is electrically connected with the charging roller 108 within the drum unit 120.

As shown in Figure 8, a metal shaft 108a of the charging roller 108 is rotatably supported by charging roller bearings 132 made of electroconductive resin material. In this manner, the charging roller 108 is mounted on the drum frame 118. Between the bearing 132 and the drum frame 118, a metal spring (elastic member) 133 is provided. This spring 133 provides an elastic force to press the charging roller 108 against the photosensitive drum 107 (not shown in Figure 8).

The input electrical contact member 141 includes an electrical contact 141a for contact with the output contact 144a and an electrical contact 141b for contact with the spring 133. The input electrical contact member 141 is constituted by an integral metal plate and is mounted to the drum frame 118.

Therefore, the input electrical contact 141a is electrically connected with the charging roller 108

through the electrical contact 141b, the spring 133, bearing 132 and the metal shaft 108a.

As shown in Figure 10, (b), one end of the input electrical contact member 141 is exposed at substantially the bottom end of the drum unit 120 and the side surface 120b1. In the exposed region 141c in which the input electrical contact member 141 is exposed, the input electrical contact 141a is disposed. However, in this embodimcnt, the input electrical contact 141a which is exposed at the side surfacc 120b1 is covered by a cartridge movable operation member142 as shown in Figure 10, (a), when the cartridge B is not mounted to the main assembly A of the apparatus (rest position). The input electrical contact member 141 is disposed within the drum unit 120 except for the portion exposed at the bottom and side surface 120b1 of the drum unit 120. The stand-by position is the position where rotation of the movable operation member 142 in the direction of an arrow an is stopped, and is the position shown in Figure 10, (a). The structure of the movable operation member 142 will be described in detail hereinafter.

(4) Movable Operation Member of Cartridge B

Referring to Figure 9, the description will be made as to the structure of the movable operation member 142 mounted on the cartridge B.

As shown in Figure 9, the drum unit 120 is provided with the movable operation member 142. The movable operation member 142 is rotatably mounted on the side surface 120b1 of the drum frame 118. A shaft 118j is provided on the side surface 120b1 and is engaged with a hole 142a1 of a cylindrical portion 142a provided in a back side 142k of the movable operation member 142. Thereafter, the drum shaft 139 (Figure 7) is press-fitted in the hole 118j1 of the shaft 118j. By doing so, the movable operation member 142 is rotatably mounted in the drum frame 118 by the drum shaft 139. The movable operation member 142 is thus mounted coaxially with the rotational axis of the photosensitive drum 107.

In this manner, the movable operation member 142 is rotatable about the shaft 118j, and therefore, when the cartridge B is mounted into or demounted from the main assembly A of the apparatus, the movable operation member 142 can be rotated rotatably. In addition, since the movable operation member 142 is engaged with the shaft 118j, the movable operation member 142 can be easily assembled with the drum frame 118. Furthermore, since the shaft 139 is also a photosensitive drum shaft, the cartridge B can be downsized. This is because there is no need of providing an additional shaft and no need of preparing a space therefor. In addition, the movable operation

member 142 is mounted on a side surface 120b1 of the cartridge B, and therefore, assembling is easy.

The cylindrical portion 142a is provided with an elastic function member (for example, a coil spring) 143.One of an arm portion 143a of the member 143 is hooked on a locking portion 142e provided on a back side of the movable operation member 142. The other end of the arm portion 143b of the elastic function member 143 is engaged with a groove 118n formed in the side surface 120b1. By doing so, the elastic function member 143 urges by the elastic force thereof the movable operation member 142 in a rotational direction indicated by an arrow a Figure 9, 10 (a)). The back side abutting portion 142b on the back side 142k of the movable operation member 142 urged by the elastic function member 143 abuts an abutting portion 118e of the drum frame 118. Thus, the movable operation member 142 is limited in the rotation range in the direction of the arrow a.

When the movable operation member 142 rotated in the direction indicated by an arrow b Figure s 9, 10, (b)), the abutting portion 142c on the back side 142k is abutted to an abutting portion 118f provided on the drum frame 118. In this manner, the movable operation member 142 is limited in the rotation range in the direction of the arrow b.

The rotating operation of the movable

operation member 142 will be described hereinafter.

In this embodiment, the provision of the elastic function member 143 is not inevitable. For example, the movable operation member 142 may be kept at the stand-by position by providing a relatively large frictional force between the drum frame 118 and the sliding surface of the back side 142k of the movable operation member 142 or by using a snap fit structure or the like. However, the use of the elastic function member 143 is advantageous as will be described hereinafter. Figure 10, (a) and (b) illustrates the states wherein the movable operation member 142 is rotated in the direction of arrow an and in the direction of arrow b. In the state of Figure 10, (a), the movable operation member 142 has been rotated in the direction of arrow an and is kept at the stand-by position. In this stand-by state, the exposed region 141c of the input electrical contact member 141 is covered by the movable operation member 142. In the state shown in Figure 10, (b), the movable operation member 142 has been rotated in the direction of arrow b. In this state, the exposed region 141c is exposed.

When the cartridge B is not mounted in place in the main assembly A of the apparatus, the movable operation member 142 takes the position shown in Figure 10, (a). In this state, the electrical contact

141a located at the exposed region 141c is covered by the movable operation member 142. Therefore, the operator is protected from inadvertently touching the exposed region 141c inter alia the input electrical contact 141a. In addition, foreign matter is prevented from depositing there.

Here, it is not inevitable to cover the exposed region 141c by the movable operation member 142. This will be described hereinafter.

(5) Charging Output Contact Member 144

The description will be made as to a charging output contact member 144 provided in the main assembly A of the apparatus.

As shown in Figure 11, (a) and (b), on an inside side plate 145 of the main assembly A of the apparatus is provided with a charging output contact member (output contact member), contacted to the input electrical contact 141a, for applying a charging voltage to the input electrical contact 141a.

A charging output contact (output contact) 144a which is a part of the output contact member 144 is contacted to the input electrical contact 141a. When the cartridge B is not mounted in the main assembly A of the apparatus, the output contact 144a is placed at a retracted position which is outer side of the inside side surface 145e of the side plate 145 in the main assembly A of the apparatus. That is, the

output contact 144a is at the retracted position which is behind the side surface 145e so that it is not projected into the cartridge mounting portion 130a.

By doing so, even if the operator inserts his or her hand into the main assembly A of the apparatus for a maintenance operation or the like for the main assembly A, the hand does not easily touch the output electrical connection member 144, inter alia the output contact 144a. Therefore, the contact member 144 and the electrical contact 144a are protected from deposition of foreign matter. Also, they are protected form being damaged. There is a possibility that operator inadvertently touch the contact member 144 and the electrical contact 144a with the result that electric circuit E which will be described hereinafter may be damaged by electrostatic discharge for a charged human body. This damage can be avoided. Therefore, the reliability of the electrical connection between the cartridge B and the main assembly A of the apparatus can be improved.

In addition, the output contact member 144 is electrically connected by lead lines with the electric circuit (voltage source circuit) E (Figure 16) provided on an electrical circuit board EC. More particularly, the output contact 144a is movable between the electrical connecting position and the retracted position where it is retracted from the

electrical connecting position and is placed in the cartridge mounting portion 130a, and the output contact 144a is electrically connected with the voltage source S (Figure 16) through the electric circuit E.

As will be best seen in Figure 11 - Figure 13, (a), (b), the side plate 145 is provided with a fixed engageable member 146 which is fixed to the side plate 145 and is projected toward the cartridge mounting portion 130a. At the downstream side of the fixed engageable member 146 with respect to the mounting direction X of the cartridge B, there is provided a displaceable engaging portion 147c (Figure 13, (b)) provided at one end of the displaceable member 147, and it projects toward the mounting portion 130a through an opening 145a1 formed in the side plate 145.

More particularly, the displaceable member 147 is provided with the displaceable engaging portion 147c. The displaceable member 147 displaces the output contact 144a between the retracted position and the electrical connecting position. The engaging portion 147c is disposed downstream of the fixed engageable member 146 with respect to the inserting direction X in which the cartridge B is inserted into the main assembly A of the apparatus. In other words, at least a part of the engaging portion 147c with

respect to the inserting direction X, is positioned behind the engageable member 146.

Accordingly, even if the operator inserts his or her hand into the main assembly A of the apparatus for the purpose of maintenance operations of the main assembly A of the apparatus, the probability of the hand inadvertently touching the engaging portion 147c can be decreased. Therefore, the output contact 144a is prevented from moving into the electrical connecting position in the state that cartridge B is not mounted to the mounting portion 130a. In this manner, the above-described advantageous effects can be provided.

With this structure, as shown in Figure 11, (a) and (b), the engaging portion 147c moves in the direction of the arrow c or the direction of arrow d in interrelation with mounting and demounting of the cartridge B.

As shown in Figure 11, (b), the engaging portion 147c is pushed by the movable operation member 142 (Figure 10) in the direction of arrow c in the process of mounting the cartridge B into the main assembly A of the apparatus. Then, the output contact 144a interrelated with the operation of the displaceable member 147 having the engaging portion 147c, pops into the cartridge mounting portion 130a or space through the opening 145a2 formed in the side

plate 145.

By doing so, the output contact 144a is brought into contact with the input electrical contact 141a in the process of mounting of the cartridge B into the main assembly A of the apparatus. Thus, the charging roller 108 is capable of receiving the voltage from the main assembly A of the apparatus through the electric circuit E in response to the control operation of the CPU200 (Figure 16) provided in the circuit board EC.

When the cartridge B is not placed in the main assembly A of the apparatus, the displaceable engaging portion 147c moves in the direction of arrow d in Figure 11, (b) by an elastic force provided by the elastic function member (for example, compression spring) 149 (Figure 13, (b)). In interrelation with the operation of the displaceable member 147 which is integral therewith, the output contact 144a is retracted to the outside of the side plate 145, namely, opposite from the mounting portion 130a with respect to the side plate 145 (Figure 11, (a)). As will be understood from Figure 11, (a), the movement of the engaging portion 147c in the direction of arrow d is limited by an edge of the opening 145a1 formed in the side plate 145. When the process cartridge B is dismounted from the main assembly A of the apparatus, the operations and movements of the elements are

opposite from those during the mounting or inserting operation.

(6) Internal Structure of Main Assembly An of Apparatus

Referring to Figure 12, the description will be made as to the internal structure of the main assembly A of the apparatus. Figure 12 is a front view of the inside of the main assembly A of the apparatus as seen from the front side D, that is, in the direction of mounting the cartridge B (Figure 3).

On the inner bottom surface of the main assembly A of the apparatus, that is, the bottom surface of the cartridge mounting portion 130a, there is a circuit board EC (Figure 16). At one lateral side of the mounting portion 130a with respect to the mounting direction, there is disposed a motor M and a driving gear train (driving force transmitting means) M1 for transmitting the driving force from the motor M to the coupling 134 or the like, outside the inside side surface 145e of the inner side plate 145.

At the opposite lateral side of the mounting portion 130a, the displaceable engaging portion 147c is disposed downstream of the fixed engageable member 146 with respect to the inserting direction X of the cartridge B relative to the main assembly A of the apparatus. In addition, at least a part of the engaging portion 147c is overlapped with the fixed

engageable member 146 as seen in the inserting direction X. In other words, a part of the engaging portion 147c is behind the fixed engageable member 146 as seen in the inserting direction X.

For this reason, even if the operator inserts his or her hand form the front side side D into the main assembly A of the apparatus for the purpose of maintenance (jam clearance operation or the like) after the cartridgc B is dismounted, the hand is blocked by the fixed engageable member 146. Therefore, the displaceable engaging portion 147c is protected from inadvertently accessed by the operator. The output contact 144a (not shown in Figure 12) placed in the retracted position is prevented from moving unintentionally to the electrical connecting position.

(7) Operations of Movable Operation Member and Charging Output Contact Member

The description will be made as to the operations of the movable operation member 142 and the charging output contact member 144. Figure 13 - Figure 15 are schematic illustrations of operations when the cartridgc B is inserted into the image forming apparatus 100.

Figure 13, (a), Figure 14, (a) and Figure 15, (a) are views as seen in the direction from the mounting portion 130a to the side plate 145, namely,

the views as seen in the direction of arrow Y in Figure 11, (a). Figure 13, (b), Figure 14, (b) and Figure 15, (b) are views as seen in the direction of an arrow Z in Figure 13, (a), Figure 14, (a) and Figure 15, (a), respectively.

As will be understood from these Figures, the displaceable engaging portion 147c is rotatably mounted on the outside of the side plate 145 (opposite side from the side having the mounting portion 130a with respect to the side plate 145). The displaceable engaging portion 147c is rotatable about the shaft portion 147a.

The output contact member 144 is mounted on the supporting member 148. The supporting member 148 is mounted, for rotation about the shaft portion 148a, to the mounting portion 145b of the side plate 145. The supporting member 148 is urged in the direction of an arrow e (Figure 13, (b)) by an elastic force provided by the elastic function member (for example, compression spring) 149. The displaceable member 147 and the supporting member 148 are abutted to each other at the abutting portions 147b, 148b thereof. Therefore, the displaceable member 147 and the supporting member 148 are interrelated with each other.

By the urging of the supporting member 148 in the direction of arrow e by the elastic function

member 149 (Figure 13, (b)), the displaceable member 147 is rotated in the direction of an arrow f. Then, the abutting portion 147d is abuted to the edge of the opening 145a1 of the side plate 145. By this, the displaceable member 147 is correctly positioned. At this time, the output contact 144a is placed in the retracted position where it is not projected beyond the side plate 145 into the inside of the main assembly A of the apparatus, that is, the output contact 144a is retracted from the electrical connecting position where the output contact 144a is electrically connected with the input electrical contact 141a. In other words, the output contact 144a is positioned out of the mounting portion 130 a. Thus, the elastic function member 149 functions to elastically urge the displaceable member 147 to move the output contact 144a to the retracted position from the electrical connecting position and keep it there.

Figure 13, (a) and (b) illustrate the states in the process of inserting the cartridge B into the main assembly A of the apparatus. More particularly, in Figure 13, (a) and (b), the cartridge B has been inserted to such a position that movable operation member 142 just before contacting to the fixed engageable member 146. The cartridge B is inserted in the direction of the arrow X along the mounting guide portions 130L1, 130L2.

As has been described in the foregoing, the movable operation member 142 is urged in the direction of the arrow j (Figure 13, (a)) by the elastic force provided by the elastic function member 143. The abutting portion 142b of the movable operation member 142 is abutted to the abutting portion 118e. As has been described, the output contact 144a is kept in the retracted position where it is not projected out beyond the side plate 145 into the mounting portion 130a.

In Figure 14, (a), (b), the cartridge B has been further inserted from the position shown in Figure 13. In the state of Figure 14, a first engaging portion 142f of the movable operation member 142 is brought into contact to the engaging portion 146a of the fixed engageable member 146. By this, the movable operation member 142 starts rotating in accordance with further insertion of the cartridge B in the direction of an arrow k (Figure 14, (a)). In this manner, the operation member 142 moves relative to the drum frame 118 (cartridge frame). This causes the abutting portion 142b to separate from the abutting portion 118e.

By the movement of the movable operation member 142 relative to the drum frame 118, the movable operation member 142 moves or rotates to such a position that movable operation member 142 is capable

of passing under the engaging portion 146, and the second engaging portion 142d abuts the displaceable engaging portion 147c (Figure 14, (a)).

Thus, when the cartridge B is inserted into the main assembly A of the apparatus, the first engaging portion 142f is brought into engagement with the fixed engageable member 146 and is rotated thereby, by which the second engaging portion 142d at the free end of the operation member 142 is moved to a position of engagement to the engaging portion 147c.

With further insertion of the cartridge B, the second engaging portion 142d pushes the engaging portion 147c of the displaceable member 147. This rotates the displaceable member 147 in the direction of an arrow g (Figure 14, (b)). By this, the supporting member 148 is rotated in the direction of an arrow h (Figure 14, (b)). Therefore, the output contact 144a is projected beyond the side plate 145 into the inside of the main assembly A of the apparatus, that is, into the cartridge mounting portion 130.

In this manner, the operation member 142 is rotated by the contact with the engaging portion 146a so that it can pass under the engaging member 146.

When the engageable member 142d is engaged with the engaging portion 147c, the operation member 142 is disengaged from the engageable member 146 and

not contacted therewith. Therefore, the movement of the operation member 142 is not limited by the engageable member 146, so that second engaging portion 142d can be assuredly engaged with the engaging portion 147c.

On the other hand, the movable operation member 142 moves from the position covering the input electrical contact 141a (Figure 10, (a)) to the position exposing the contact 141a (Figure 10, (b)).

Figure 15, (a) and (b) shows the state in which the cartridge B is further inserted to the complete set position in the main assembly A of the apparatus. With the insertion of the cartridge B, the second engaging portion 142d further rotate the displaceable member 147 in the direction of the arrow g (Figure 15, (b)). In interrelation therewith, the output contact 144a is further projected into the main assembly A of the apparatus beyond the side plate 145. The output contact 144a is then brought into contact to the exposed input electrical contact 141a. At this time, the movable operation member 142 passes under the engageable member 146 and is separated from the fixed engageable member 146. The movable operation member 142 receives a reaction force from the displaceable member 147 in the direction of an arrow i (Figure 15, (a)), by which the abutting portion 142c is abutted to the abutting portion 118f and is

correctly positioned.

Thus, the movable operation member 142 is movable relative to the drum frame 118 (cartridge frame). When the cartridge B is inserted into the main assembly A of the apparatus, the movable operation member 142 is engaged with the fixed engageable member 146 fixed on the main assembly A of the apparatus and is moved relative to the drum frame 118. After the movable operation member 142 is engaged the fixed engageable member 146, it is engaged with the engaging portion 147c of the displaceable member 147 to move the output contact 144a from the retracted position to the electrical connecting position against the elastic force of the elastic function member 149. More particularly, when the cartridge B is inserted into the main assembly of the apparatus, the operation member 142 is engaged with the engaging member 146, and moves the engaging member 146 relative to the drum frame 118 to a retractable position to permit the further insertion of the cartridge B. The operation member 142, after engaging with the engaging member 146, engages with the displaceable engaging portion 147c to push the displaceable engaging portion 147c. By this, the contact 144a is moved from the retracted position to the electrical connecting position.

The movable operation member 142 further

includes the elastic function member 143 for applying an elastic force to the movable operation member 142, and when it is engaged with the fixed engageable member 146, it moves relative to the drum frame 118 against the elastic force of the elastic function member 143.

The movable operation member 142 includes the first engaging portion 142f engageable with the fixed engageable member 146 and the second engaging portion 142d engageable with the displaceable engaging portion 147c. When the movable operation member 142 is inserted into the main assembly A of the apparatus, the movable operation member 142 is moved relative to the drum frame 118 by engagement of the first engaging portion 142f with the fixed engageable member 146. The movable operation member 142 moves the output contact 144a from the retracted position to the electrical connecting position by engagement of the second engaging portion 142d with the engaging portion 147c of the displaceable member 147 after the engagement of the first engaging portion 142f with the fixed engageable member 146.

The electrical connecting position in this specification is a position where the input electrical contact 141a and the output contact 144a are electrically connected to each other. More particularly, it is the position where when the

cartridge B is mounted to the mounting portion 130a, the input electrical contact 141a and the output contact 144a are electrically connected to each other.

The retracted position is a position where the output contact 144a is present when the cartridge B is not placed in the main assembly A of the apparatus. In the case that contact is at the retracted position, when the operators hand or the like enters the main assembly A of the apparatus, the hand or the like less easily touch the contact 144a than when the electrical contact 144a is at the electrical connecting position. Thus, when the electrical contact 144a is at the retracted position, the probability of the hand touching the contact 144a is lower than when the electrical contact 144a is at the electrical connecting position. In the specification, there are shown examples in which the retracted position is outside (opposite from the mounting portion 130a with respect to the side plate 145) the inner side surface 145a of the side plate 145 provided in the main assembly A of the apparatus, or the electrical contact 144a is disposed opposite from the mounting portion 130a with respect to the cover portion 171 (Embodiment 2), or the electrical contact 144a is disposed between vertical plates 145f (Embodiment 9), but this is not limiting, and may be another position provided that above-described

conditions are satisfied.

As described in the foregoing, according to this embodiment, in this embodiment, when the cartridge B is inserted into the main assembly A of the apparatus, the output contact 144a which has been kept in the retracted position is brought into contact with the input electrical contact 141a by the operations of the movable operation member 142, the displaceable member 147 and the supporting member 148. By the control of the CPU200 (Figure 16), the voltage is supplied from the voltage source S (Figure 16) to charging roller 108 through the electric circuit E, the output contact 144a and the input electrical contact 141a. In this embodiment, the voltage source S and the electrical contact 144a are always connected electrically with each other through the electric circuit E.

The input electrical contact 141a is contacted with the output contact 144a placed at the electrical connecting position to receive the voltage for operating the charging roller 108 (said process means).

(8) Circuit Board (Electric Circuit E)

Referring to Figure 16, the description will be made as to the circuit board EC provided in the main assembly A of the apparatus in this embodiment. The circuit board EC is disposed below the cartridge

mounting portion 130a. The circuit board EC comprises the CPU200 and the electric circuit E (voltage source circuit).

The circuit board EC, more particularly, the electric circuit E is connected with the voltage source S. The electric circuit E is constituted by a charging bias circuit E1, a developing bias circuit E2 and a transfer/charging bias circuit E3.

The charging bias circuit E1 generates a negative DC voltage and an AC voltage. It applies a voltage in the form of a sum of these voltages to the charging roller 108. The charging roller 108 which receives the voltage and charges the photosensitive drum 107.

The charging bias circuit E1 applies the negative DC voltage also to the fixing roller 105b through a driving roller 105c. The developing bias circuit E2 generates a negative DC voltage and an AC voltage. The developing roller 110 is supplied with a voltage in the form of a sum of these voltages. The developing roller 110 receives the voltage to develop the electrostatic latent image with the developer. The transfer bias circuit E3 generate a positive or negative DC voltage. It applies positive or negative DC voltage to the transfer roller 104.

Thus, the charging roller 108 is supplied with the voltage from the voltage source S through the

charging bias circuit E1. The fixing roller 105b and the driving roller 105c are supplied with the voltage from the voltage source S through the charging bias circuit E1. The developing roller 110 is supplied with the voltage from the voltage source S through the developing bias circuit E2. The transfer roller 104 is supplied with the voltage from the voltage source S through the transfer/charging bias circuit E3.

These circuits E1, E2, E3 are on-off-controlled in response to instructions from the CPU200 provided on the circuit board EC.

As described in the foregoing, according to this embodiment, even if the operator inserts his or her hand into the main assembly A of the apparatus for the purpose of jam clearance (removal of the recording material 102 from the main assembly A when the recording material 102 is jammed in the main assembly A) or for the purpose of the maintenance operation, the output contact 144a is not easily touched by the hand. This is because the output contact 144a is retracted to the retracted position. Therefore, (1) the output contact 144a is protected from deposition of foreign matter (developer, grease, sweat or the like deposited on the hand). It is possible that grease or the developer on parts in the main assembly A of the apparatus contaminates the operators hand, and if this occurs, the they are liable to contaminate

the output contact 144a. (2) Or, the output contact 144a is not damaged. (3) Or, elements in the electric circuit E in the main assembly A of the apparatus (Figure 16) can be prevented from the damage which may be caused by the electrostatic noise. This is because static electricity of the human body may be applied on the output contact 144a. This is an electrostatic noise, which, however, can be avoided according to this embodiment.

Accordingly, electrical conduction defect from the voltage source S (Figure 16) to the charging roller 108 can be suppressed by (1), (2) and (3). In this manner, the reliability of the electrical connection between the output contact 144a and the input electrical contact 141a can be improved.

As described in the foregoing, the engaging portion 147c of the displaceable member 147 is disposed downstream of the fixed engageable member 146 with respect to the inserting direction X, and at least a part of the engaging portion 147c as seen in the direction of the inserting direction X. Namely, as seen in the direction of the inserting direction X, at least part of the engaging portion 147c is positioned behind the engageable member 146. Therefore, even if the operator inserts his or her hand into the main assembly A of the apparatus for the purpose of maintenance operation such as jam clearance

or the like, the engageable member 146 is effective to prevent the hand from touching the engaging portion 147c.

Thus, unintentional movement of the output contact 144a placed in the retracted position to the electrical connecting position can be avoided.

As has been described, in the process of insertion of the cartridge B into the main assembly A of the apparatus, the engaging portion 147c is moved against the elastic force of the elastic function member 149.

Therefore, a shock or impact on the cartridge B upon mounting to the mounting portion 130a by insertion of the cartridge B into the main assembly A of the apparatus can be buffered or eased by the elastic force. Thus, the shock or impact received by the cartridge B from the main assembly A of the mounting upon the mounting to the mounting portion 130a can be reduced.

This is effective to prevent the damage of the main assembly A of the apparatus and the cartridge B attributable to such an impact. In addition, leakage of the developer from the cartridge B to the outside can be prevented. Furthermore, an impact upon contact or abutment between the output contact 144a and the input electrical contact 141a can be reduced. This is effective to prevent the damage of the contact

members 141, 144.

Additionally, according to the foregoing embodiment, the movable operation member 142 is elastically urged toward the front side, that is, in the direction opposite to the inserting direction X by the elastic force of the elastic function member 143. When the cartridge B is inserted into the main assembly A of the apparatus, the operation member 142 is moved against the elastic force. Therefore, the impact can be reduced by the elastic force. In such a case, the impact can be buffered by a sum of the elastic force of the elastic function member 143 and the elastic force of the elastic function member 149. Thus, the adverse affect of the impact can be minimized.

In summary, this embodiment can provides the following advantageous effects:

(1) even if the operator inserts his or her hands into the main assembly of the image forming apparatus for the purpose of jam clearance operation or the like when the process cartridge is not mounted in the main assembly of the image forming apparatus, the electrical contact is not easily touched by the hand, since the output contact is not projected into the inside of the main assembly A of the apparatus beyond the inner side surface. As seen in the direction of insertion of the process cartridge into the main

assembly of the image forming apparatus, the displaceable engaging portion which is effective to project the output contact is disposed behind the rear surface of the fixed engageable member which is fixed to the main assembly. Therefore, the operator cannot easily touch the displaceable engaging portion in the main assembly of the apparatus, either. Therefore, conduction defect which can be caused by deposition of sweat or grease or the like can be avoided. In addition, the output contact member in the main assembly of the apparatus can be protected from application of electrostatic noise, and therefore, failure of the element in the electric circuit in the main assembly of the apparatus can be avoided.

(2) by interrelating the motion of the movable operation member with the mounting and demounting operation of the cartridge, the operator does not need to do something particular in order to contact the electrical contacts.

(3) the contact member is disposed at the side opposite to the driving side, and therefore, the space in the main assembly of the image forming apparatus can be effectively utilized, thus accomplishing downsizing of the apparatus.

(4) the electrical contact of the process cartridge is disposed at the lower position, the assembling property is improved. In this case, by moving the

movable operation member upwardly, the movable operation member is not projected toward the main assembly of the image forming apparatus, so that main assembly of the image forming apparatus can be downsized.

(5) the movable operation member rotates about the shaft, and therefore, the motion of the movable operation member when the process cartridge is mounted to or demounted from the main assembly of the image forming apparatus can be made smooth.

(6) since the movable operation member is engaged with the shaft, assembling operation is easy.

(7) the movable operation member is urged by an elastic function member such as a twisted coil spring, and when the process cartridge is inserted into the main assembly of the image forming apparatus, the movable operation member is moved against the elastic force. The impact upon the mounting of the process cartridge into the main assembly of the image forming apparatus can be minimized. By doing so, the damage of the process cartridge and/or the main assembly of the image forming apparatus, and/or the developer leakage can be prevented. By easing the impact upon the abutment between he electrical contact of the main assembly and the electrical contact of the process cartridge, the damage of the contact members can be avoided.

(8) in the case that movable operation member is co-axial with the rotation shaft of the photosensitive drum, there is no need of using additional rotational shaft so that process cartridge can be downsized. By disposing the movable operation member on a side surface, the assembling property is improved.

Embodiment 2

Referring to Figure 17 - Figure 21, the second embodiment will be described.

In this embodiment, the structure of the cartridge B and the image forming apparatus 100 are similar to those of Embodiment 1 (Figure s 1 and 2). The same reference numerals as in Embodiment 1 are assigned to the elements having the corresponding functions in this embodiment, and the detailed description thereof is omitted for simplicity.

(1) Movable Operation Member of Cartridge B

Figure 17 - Figure 19 are perspective views of a leading side portion of the cartridge B with respect to direction in which the cartridge B is mounted to the main assembly A of the apparatus according to this embodiment.

In this embodiment, the cartridge B comprises a drum unit 120 and a developing unit 119 integrally.

Adjacent a longitudinal end at a leading side of the cartridge B with respect to the mounting

direction, there is provided an electrical contact 141a of a charging input electrical contact member 141 for application information a charging bias voltage to the charging roller 108. The electrical contact 141a is not projected beyond the surface of the drum frame 118 by the rib 118g surround it. A region adjacent a corner portion of the input electrical contact member 141 functions as a contact 141a for contact with the charging output contact 144a provided in the main assembly A of the apparatus.

The drum frame 118 is provided with a drum shutter 170 for protecting a photosensitive drum 107. The drum shutter 170 has a shutter portion 170a covering the photosensitive drum 107 and supporting arms 170b at the opposite ends (only one end is shown), and is rotatable about a pivot. The drum shutter 170 rotates in the direction of an arrow s in interrelation with the cartridge B mounting operation into the main assembly A of the apparatus and moves from a protection position for protecting the photosensitive drum 107 (Figure 17, (a)) to an exposing position for exposing the photosensitive drum 107 (Figure 17, (b)). In Figure 18, the drum shutter 170 is omitted for simplicity.

In this embodiment, the drum frame 118 is provided with a movable operation member 142 which is rotatably mounted thereon by a shaft 118h. The

movable operation member 142 is disposed outside of a path of the rotating supporting arm 170b with respect to the direction of the rotational shaft of the drum shutter 170.

To the movable operation member 142, a coil spring 143 (elastic function member) is mounted on a cylindrical portion 142a thereof, and one of an arm portion 143a thereof is hooked on a locking portion 142e. The other drum frame 118 is hooked on a locking portion 1181 of the drum frame 118. By such a spring 143, the movable operation member 142 is biased in the rotational direction of arrow a. The movable operation member 142 urged by the spring 143 is positioned in the rotational direction by abutment of the abutting portion 142b to the abutting portion 118e of the drum frame 118 (Figure 19, (a)).

The movable operation member 142 is rotatable in the direction of arrow b until the abutting portion 142c abuts the abutting portion 118f of the drum frame 118 (Figure 19, (b)).

(2) Charging Output Contact 144a of Main Assembly An of Apparatus

The description will be made as to the main assembly A of the apparatus to which the cartridge B is mountable.

As shown in Figure 20, the inner side plate 145 of the main assembly A of the apparatus is

provided with a charging output contact member 144 for applying the charging bias voltage through contact with the input electrical contact member 141 of the cartridge B.

When the cartridge B is not mounting in the main assembly A of the apparatus, the output contact member 144 is placed at a retracted position where it does not project into the inside of the main assembly A of the apparatus beyond the cover portion 171 which is provided on an inner side surface 145e of the inner side platc 145 of the main assembly A of the apparatus (Figure 20, (a)). Namely, the electrical contact 144a is retracted to the side opposite from the cover member 171 with respect to the inner side plate 145. The output contact member 144 is connected to an electric circuit E (Figure 16) within the inside of the main assembly A of the apparatus through a lead wire or the like.

In the main assembly A of the apparatus, there is provided a fixed engageable member 146 for rotating the movable operation member 142 in interrelation with mounting operation of the cartridge B, and the fixed engageable member 146 is projected from the inside side surface 145e toward the inside. Downstream of the fixed engageable member 146 with respect to the mounting direction of the cartridge B, there is provided a displaceable member 147.

In this embodiment, the displaceable member 147 is rotatable about the shaft portion 147a. The displaceable member 147 rotates in interrelation with mounting and demounting operation of the cartridge B. As shown in Figure 20, (b), when the cartridge B is inserted into the main assembly A of the apparatus, the displaceable member 147 is urged by the movable operation member 142 of the cartridge B and rotates in the direction of arrow c. By this, the output contact member 144 projects to the outside electrical connecting portion beyond the cover portion 171. And, the output contact 144a is brought into contact to the contact 141a of the input electrical contact member 141 of the cartridge B.

(3) Operations of Movable Operation Member and Charging Output Contact

The description will further be made as to the operations of the movable operation member 142 of the cartridge B and the charging output contact member 144 provided in the main assembly A of the apparatus.

Figure 21 is a schematic illustration of operations when the cartridge B is inserted into the main assembly A of the apparatus.

Figure 21 is a view of the inner side plate 145 of the main assembly A of the apparatus as seen from inside of the main assembly A of the apparatus (Figure 20, (a) in the direction of arrow Y). Figure

21, (a), shows a state in the process of insertion of the cartridge B into the (a) of the Figure 21, Figure 21, (b) shows a state in which the cartridge B is mounted in place in the main assembly A of the apparatus.

As shown in Figure 21, (a), the displaceable member 147 is mounted on the side plate 145 for rotation about the shaft portion 147a. The output contact member 144 is mounted on the member 147. The displaceable member 147 is urged by the coil spring 149 (elastic function member) in the direction of arrow d, so that abutting portion 147d is abutted to the abutting portion 145d of the side plate 145 and is kept there. At this time, the output contact member 144 is positioned at the retracted position such that it does not project beyond the cover portion 171 of the side surface 145e into the main assembly A of the apparatus. In other words, the electrical contact member 144 is placed an outside position (retracted position) opposite from the mounting portion 130a with respect to the cover portion 171.

The cartridge B is inserted in the direction of an arrow X along the main assembly guides 130L1, 130L2.

When the cartridge is at the position shown in Figure 21, (a), the movable operation member 142 is biased in the direction of an arrow j by the elastic

function of the coil spring 143 (elastic function member), as described hereinbefore. And, the operation member 142 is kept at the position where the abutting portion 142b is abutted to the abutting portion 118e of the drum frame 118. In addition, the output contact member 144 is kept at the retracted position where it does not project beyond the cover portion 171, as described hereinbefore.

When the cartridge B is further inserted from the position shown in Figure 21, (a), a first engaging portion 142f of the movable operation member 142 is brought into contact to the contact portion 146a of the fixed engageable member 146 provided fixed on the main assembly A of the apparatus. Thus, the operation member 142 is rotated in the direction of an arrow k. And, the second engaging portion 142d of the operation member 142 urges the displaceable engaging portion 147c of the displaceable member 147 upwardly. This rotates the displaceable member 147 in the direction of an arrow c. Thus, the charging output contact member 144 is projected beyond the cover portion 171. In accordance with, the electrical contact 144a is moved to an electrical connecting position from the retracted position.

As shown in Figure 21, (b), when the cartridge B is mounted completely to the mounting portion 130a, the output contact 144a projected beyond

the cover portion 171 is contacted to the input electrical contact 141a of the cartridge B. This enables to supply the charging bias to the charging roller 108 of the cartridge B from the main assembly A of the apparatus.

In Embodiment 2, similarly to the above-described Embodiment 1, the operation member 142 is movable relative to the cartridge frame B1. When the cartridge B is inserted into the main assembly A of the apparatus, the operation member 142 is engaged with the fixed engageable member 146 provided fixed in the main assembly A of the apparatus to move relative to the cartridge frame B1. The operation member 142, after engaging with the fixed engageable member 146, is brought into contact with the displaceable engaging portion 147c of the displaceable member 147 to move the output contact 144a from the retracted position to the electrical connecting position against the elastic force of the coil spring 149 (the elastic function member).

In addition, it has the input electrical contact 141a for receiving the voltage for operating the charging roller 108 (said process means) through engagement with the output contact 144a placed at the electrical connecting position.

It further includes a spring 143 (elastic function member) for applying an elastic force to the

operation member 142. When the operation member 142 is engaged with the engageable member 146, the operation member 142 moves relative to the cartridge frame B1 against the elastic force of the spring 143.

The operation member 142 includes a first engaging portion 142f engageable with the engageable member 146 and a second engaging portion 142d engageable with said displaceable engaging portion 147c. The first engaging portion 142f of the operation member 142, when the cartridge B is inserted into the main assembly of the apparatus, is engaged with the engageable member 146, so that it moves relative to the cartridge frame B1, and after the first engaging portion 142f is engaged with the engageable member 146, the second engaging portion 142d is engaged with the displaceable engaging portion 147c. By this, the output contact 144a is moved from the retracted position to the electrical connecting position.

When the cartridge B is insertion into the main assembly A of the apparatus, the first engaging portion 142f is engaged with the operation member 142 and is rotated. So, the second engaging portion 142d provided at the leading end of the operation member 142 moves to the position for engagement with the displaceable engaging portion 147c and engages with the displaceable engaging portion 147c. When the

second engaging portion 142d is engaged with the displaceable engaging portion 147c, the operation member 142 is engaged with the engageable member 146 and is not contacted therewith.

Similarly to Embodiment 1, a main assembly A of electrophotographic image forming apparatus includes a cartridge mounting portion 130a for detachably mounting the process cartridge B; a fixed engageable member 146; an output contact 144a movable between an electrical connecting position and a retracted position retracted from the electrical connecting position; and a displaceable member 147 having a displaceable engaging portion 147c for moving the output contact, wherein the displaceable engaging portion is disposed downstream of the fixed engageable member 146, and at least a part of said displaceable engaging portion 147c is overlapped with the fixed engageable member 146 with respect to a direction in which the process cartridge B is inserted; and an elastic function member 149 for elastically urging the displaceable member 147 to urge the output contact 144a toward the retracted position away from the electrical connecting position.

This embodiment also provides the advantageous effects similar to Embodiment 1.

In this embodiment, the operation member 142 is disposed outside the movement path of the

supporting arm 170b with respect to the rotational shaft of the drum shutter 170. Therefore, it is not necessary to pay attention to the opening and closing timing relations between the shutter 170 and the operation member 142 upon the mounting and demounting of the cartridge B.

Embodiment 3

Referring to Figure 22 - Figure 25, the description will be made as to a third embodiment of the present invention.

In this embodiment, the general arrangements of the cartridge B and the image forming apparatus 100 are the same as those described with respect to the first embodiment. The same reference numerals as in Embodiment 1 are assigned to the elements having the corresponding functions in this embodiment, and the detailed description thereof is omitted for simplicity.

In this embodiment, the cartridge B and the main assembly A of the apparatus also comprise a movable operation member 142, a displaceable member 147, a charging input electrical contact member 141, and charging output contact member 144 and so on, and these members have the respective structures and functions which are similar to those with Embodiment 1. Therefore, the detailed descriptions of these

members have been omitted for simplicity, and the same reference numeral are assigned to the corresponding elements.

Figure 22 - Figure 25 are schematic view illustrating operations when the cartridge B is inserted into the main assembly A of the apparatus.

In this embodiment, the cartridge B is provided with the movable operation member 142 which is rotatably mounted on a side surface of the drum frame 118. In this embodiment, similarly to Embodiment 1, the side surface of the cartridge B has a contact 141a of the charging input electrical contact member 141 for applying a charging bias voltage to the charging roller 108.

As shown in Figure 22, the movable operation member 142 is biased or urged in the clockwise direction (the direction of an arrow j) in the drawing by a coil spring 143 (elastic function member). When the cartridge B is not mounted in the main assembly A of the apparatus, the input electrical contact 141a is covered by the operation member 142.

Similar Lines to the above-described embodiment, the inner side plate 145 of the main assembly A of the apparatus is provided on the side surface 145e with an output contact member 144 for applying a charging bias voltage to the charging roller (unshown) by elcctrical contact with the input

electrical contact 141a. The fixed engageable member 146 and the displaceable member 147 have the similar structures as with Embodiment 1.

The displaceable member 147 moves in the directions of an arrows c, d in interrelation with mounting and demounting of the cartridge B. When the cartridge B is inserted into the main assembly A of the apparatus, the displaceable member 147 is pushed in the direction of an arrow c by the operation member 142. In interrelation with operation of the displaceable member 147, the output contact 144a is projected through the opening 145a2 of the inner side plate 145 and is brought into contact with the charging input electrical contact 141a. The structure is similar to that of Embodiment 1.

The description will be made as to the operations of the movable operation member 142 and the output contact member 144.

As described hereinbefore, Figure 22 - Figure s 25 are schematic views illustrating the operation when the cartridge B is inserted into the main assembly A of the apparatus.

Figure s 22, 23, 24, 25, (a) are views of the inner side plate 145 of the main assembly A of the apparatus as seen from the inside of the main assembly A of the apparatus, and Figure 25, (b) is the view as seen in the direction of an arrow Z in Figure 25, (a).

Figure 22 show the state in the process of insertion of the cartridge B into the main assembly A of the apparatus. More particularly, Figure 22 shows a state in which the cartridge B has been inserted to immediately before the operation member 142 is contacted to the fixed engageable member 146. The cartridge B is inserted in the direction of an arrow X along the main assembly guides 130L1, 130L2.

As described hereinbefore, the movable operation member 142 is urged in the clockwise direction (the direction of an arrow j) in Figure 22 by the elastic force of the elastic function member 143.

Figure 23 shows a state in which the cartridge B has been inserted further in the direction X (inward) from the position shown in Figure 22. As shown in Figure 23, the abutting portion of the operation member 142, that is, the first engaging portion 142f is brought into contact with the abutting portion 146a of the fixed engageable member 146 mounted on the main assembly A of the apparatus. The operation member 142 rides on the upper surface of the abutting portion 146a. Then, the operation member 142 rotates in the counterclockwise direction (the direction of an arrow k) in accordance with insertion of the cartridge B. In this state, the output contact 144a is at the retracted position where it is not

projection beyond the side plate 145 toward the mounting portion 130.

In accordance with the further insertion of the cartridge B, the first engaging portion 142f rides over the fixed engageable member 146. As shown in Figure 24, the first engaging portion 142f is then disengaged from the fixed engageable member 146. As shown in Figure 25, (a) and (b), by the further insertion of the cartridge B thereafter, second engaging portion 142d of the operation member 142 is brought into contact with the displaceable engaging portion 147c.

After the contact, the further insertion of the cartridge B causes the operation member 142 to push the displaceable member 147 in the direction of the arrow c.

With this structure of this embodiment, when the second engaging portion 142d is abuted to the displaceable engaging portion 147c, the impact or shock can be reduced.

As described hereinbefore, the displaceable member 147 is rotated in the direction of an arrow g (Figure 25, (b)) by the operation member 142 pushing the displaceable member 147 in the direction of the arrow c. By this, the supporting member 148 is rotated in the direction of an arrow h (Figure 25, (b)). Therefore, the output contact 144a is

projection out of the outside (retracted position) of the side plate 145 into the inside (electrical contact position) of the main assembly A of the apparatus, that is, into the cartridge mounting portion 130.

On the other hand, as shown in Figure 25, (a), by the movement of the operation member 142 as described above, the operation member 142 is rotated in the counterclockwise (arrow k) direction by the displaceable member 147. Therefore, the operation member 142 moves relative to the cartridge frame B1 from the position covering the input electrical contact 141a (Figure 22 - Figure 24) to the position exposing the contact 141a (Figure 25, (a), (b)).

In other words, Figure 25, (a) and (b) show the state in which the cartridge B is further inserted and is completely mounted to the main assembly A of the apparatus. With the insertion of the cartridge B, the second engaging portion 142d further rotate the displaceable member 147 in the direction of the arrow g (Figure 25, (b)). In interrelation therewith, the output contact 144a is further projected beyond the side plate 145. The output contact 144a is then brought into contact to the exposed input electrical contact 141a.

Thus, the movable operation member 142 is movable relative to the drum frame 118 (cartridge frame B1). When the cartridge B is inserted into the

main assembly A of the apparatus, the movable operation member 142 is engaged with the fixed engageable member 146 fixed on the main assembly A of the apparatus and is moved relative to the drum frame 118. After the movable operation member 142 is engaged the fixed engageable member 146, it is engaged with the engaging portion 147c of the displaceable member 147 to move the output contact 144a from the retracted position to the electrical connecting position against the elastic force of the elastic function member 149.

As described in the foregoing, in this embodiment, when the cartridge B is inserted into the main assembly A of the apparatus, the output contact 144a retracted in the retracted position is brought into contact with the input electrical contact 141a by the operations of the movable operation member 142, the displaceable member 147 and the supporting member 148. By the control of the CPU200 (Figure 16), the voltage is supplied from the voltage source S (Figure 16) to charging roller 108 through the electric circuit E, the output contact 144a and the input electrical contact 141a.

In other words, the input electrical contact 141a is engaged with the output contact 144a positioned at the electrical connecting position and receives the voltage for operating the charging roller

108 (said process means).

In this embodiment, the advantageous effects of the first embodiment are provided.

Embodiment 4

Referring to Figure s 26 and 27, the description will be made as to a fourth embodiment of the present invention.

In this embodiment, the structure of the cartridge B and the image forming apparatus 100 are similar to those of Embodiment 1 (Figure s 1 and 2). The same reference numerals as with Embodiment 1 are assigned to the elements having the corresponding functions, and the detailed descriptions for such elements are omitted for simplicity.

In Embodiment 1, as shown in Figure 10, (a), when the operation member 142 is in the stand-by state (positioned after the rotation in the direction of an arrow a), the region 141c to be exposed of the input electrical contact member 141 is covered by the movable operation member 142. In the operating state shown in Figure 10, (b), the region 141c is exposed.

Thus, when the cartridge B is not mounted to the main assembly A of the apparatus, the operation member 142 is in the position shown in Figure 10, (a). Therefore, the electrical contact 141a in the region 141c is covered by the operation member 142. For this

reason, there is an advantage that input electrical contact 141a is protected from contact of the operator to the region 141c, particularly the input electrical contact 141a.

However, it is not inevitable to cover the exposure region 141c with the operation member 142.

As shown in Figure s 26 and 27, in the present embodiment, an operation member 142 having the structures and the functions which are similar to those of Embodiment 1 is mounted to the side surface 120b1, using the drum shaft 139 and a shaft 118j (Figure 27) on the side surface 120b1 of the drum frame 118. Similarly to Embodiment 1, after engagement of the hole of the cylindrical portion 142a (Figure 9) formed in the movable operation member 142 the drum shaft 139 is press-fitted into the hole of the shaft 118j. By doing so, the operation member 142 is rotatably mounted coaxially with the rotational axis of the photosensitive drum 107.

In this embodiment, the operation member 142 is also rotatable in the directions of an arrows an and b (Figure 26).

However, in this embodiment, when the operation member 142 is in the stand-by state (Figure 26) (the position after the operation member 142 is rotated in the direction of an arrow a), the exposed region 141c of the input electrical contact member 141

is not covered by the movable operation member 142. Namely, in the stand-by position shown in Figure 26, the exposed region 141c is actually exposed.

As will best be understood from Figure 27, the input electrical contact 141a in this embodiment is provided on a surface surrounded by a rib 118g such that input electrical contact 141a does not project out beyond the side surface of the drum frame 118.

Therefore, according to this embodiment, the input electrical contact 141a is hard to touch by the operator, when the cartridge B is handled. Therefore, the contact 141a is protected from conduction defect which may otherwise be caused by the sweat, grease or the like. Thus, the contact 141a is protected without use of the operation member 142 covering the contact 141a.

In this embodiment, the advantageous effects of the first embodiment are provided.

Embodiment 5

Referring to Figure 28 - Figure 32, fifth embodiment will be described.

In this embodiment, the structure of the cartridge B and the image forming apparatus 100 are similar to those of Embodiment 1 (Figure s 1 and 2). The same reference numerals as with Embodiment 1 are assigned to the elements having the corresponding

functions, and the detailed descriptions for such elements are omitted for simplicity.

In Embodiment 4, as shown in Figure 27, the input electrical contact 141a is surrounded by the rib 118g, so that it is not projected beyond the side surface of the drum frame 118. By doing so, the exposed input electrical contact 141a is hard to touch.

In this embodiment, another structure of the movable operation member 142 is employed to prevent the operator from inadvertently touching the input electrical contact 141a.

Figure 28 to Figure 32 show various examples of the movable operation member 142 according to this embodiment.

In these examples, the side surface 120b1 of the drum frame 118 is provided with a contact 141a of the input electrical contact member 141 similarly to Embodiments 1 and 4. Similarly to the foregoing embodiments, the movable operation member 142 is supported and positioned.

In the example shown in Figure 28, the movable operation member 142 is positioned in the stand-by state so as to cover the contact 141a similarly to Embodiment 1. However, the movable operation member 142 facing the contact 141a is provided with an opening 142p. In other words, the

contact 141a is not covered by the operation member 142, but there is a surface of the operation member 142 at a position higher than the surface of the contact 141a.

In the example shown in Figure 29, the movable operation member 142 has a rib 142g so as to cover a part of the upper portion of the contact 141a in the stand-by state or position.

Figure s 30, 31 and 32 show other examples. The movable operation member 142 in each of these examples is provided around a part of the contact 141a with a surface 142r (Figure 30), 142s (Figure 31) or 142t (Figure 32) which is higher than the surface of the contact 141a in the stand-by state.

In the example of Figure 30, the surface 142r of the operation member 142 is disposed below the contact 141a in the Figure. In the example of Figure 31, the surface 142s of the operation member 142 is disposed at a side of the contact 141a. In the example of Figure 32, the surface 142t of the operation member 142 is disposed at a lower corner portion of the contact 141a.

In these examples, similarly to Embodiment 4, a surface higher than the contact 141a surface is provided adjacent the contact 141a of the operation member 142. Therefore, there is provided a hard-to-touch electrical contact, so that operator does not

inadvertently touch the contact. In this manner, the contact is protected from conduction defect which may otherwise be caused by the sweat, grease or the like.

In this embodiment, the advantageous effects of the first embodiment are provided.

Embodiment 6

Referring to Figure 33 - Figure 38, a sixth embodiment of the present invention will be described.

In this embodiment, the structure of the cartridge B and the image forming apparatus 100 are similar to those of Embodiment 1 which has been described in conjunction with Figure s 1 and 2. The structures and functions of the operation member 142 are similar to those in Embodiment 2. The same reference numerals as with the Embodiments 1 and 2 are assigned to the elements having the corresponding functions, and the detailed descriptions for such elements are omitted for simplicity.

In Embodiment 2, in the stand-by state shown in Figure 17, (a), the input electrical contact 141a is covered by the operation member 142. In the operative state shown in Figure 18, the contact 141a is exposed.

In the present embodiment, the operation member 142 of Embodiment 2 is modified. The operation member 142 is modified and is still effective to

prevent the operator from inadvertently touch the input electrical contact 141a.

Figure 33 to Figure 38 show various examples of the operation member 142 according to this embodiment.

In these examples, an input electrical contact 141a is provided so as not to project beyond the surface of the drum frame 118g adjacent a longitudinal end at a leading side with respect to the mounting direction in which the cartridge B is mounted to the main assembly A of the apparatus. The input electrical contact member 141 is provided adjacent the corner portion with a region constituting a contact 141a for contact with the charging output contact 144a. The operation member 142 is supported and positioned in the similar manner as with Embodiment 2.

In the embodiment shown in Figure 33, the operation member 142, similarly to Embodiment 2, is positioned such that it covers the contact 141a, in the stand-by state. However, unlike Embodiment 2, the area of the operation member 142 facing the contact 141a is provided with an opening 142p.

However, the contact 141a is surrounded by a rib 118g. Adjacent the contact 141a, the operation member 142 is disposed so as to substantially enclose the contact 141a. Therefore, the exposed input electrical contact 141a is protected from touch by the

operator.

In the example of Figure 34, the operation member 142 surrounds the circumference of the contact 141a in the stand-by state. In this embodiment, the portion of the operation member 142 surrounding the contact 141a has a skelton structure constituted by a plurality of bones 142u.

In the example shown in Figure 35, the operation member 142 is provided with a rib 142v so as to cover a part of the upper portion of the contact 141a in the stand-by state.

In the example of Figure s 36, 37, 38, the operation members 142 have respective surfaces 142w, 142x, 142y having heights larger than the surfaces of the contacts 141a in the stand-by state around a part of the circumference of the contact 141a.

Thus, in the embodiment of Figure 36, the surface 142w of the operation member 142 is disposed above the contact 141a in the Figure. In the example of Figure 37, the surface 142x of the operation member 142 is disposed opposed to the contact 141a in the Figure. In the example of Figure 38, the surface 142y of the operation member 142 is disposed at the side of the contact 141a.

In each of these examples of this embodiment, similarly to Embodiments 4 and 5, the movable operation member 142 is provided with a rib 142u or a

rib 141v or a surface 142w, a surface 142x or a surface 142y having a larger height adjacent the contact 141a. Therefore, there is provided a hard-to-touch arrangement, and although the electrical contacts are exposed in Embodiments 4, 5, 6, the probability of the operator inadvertently touching the electrical contact can be reduced. Thus, the contact 141a can be protected.

In this embodiment, the advantageous effects of the first embodiment are provided.

Embodiment 7

Referring to Figure 39 - Figure 44, a seventh embodiment of the present invention will be described.

In this embodiment, the cartridge B is provided on the side surface with a charging input electrical contact 141a for applying a charging bias voltage to the charging roller 108.

In this embodiment, the side surface of the cartridge B is also provided with, in addition to the charging input electrical contact 141a, development input electrical contact 160a which is a part of a development input electrical contact member 160 for applying a developing bias voltage to the developing roller 111 of the developing unit 119.

In this embodiment, the structure of the cartridge B and the image forming apparatus 100 are

similar to those of Embodiment 1 which has been described in conjunction with Figure s 1 and 2. The same reference numerals as with the Embodiment 1 are assigned to the elements having the corresponding functions, and the detailed descriptions for such elements are omitted for simplicity.

(1) Movable Opcration Member of Cartridge B

Figure 39 show a cartridge B according to a seventh embodiment of the present invention. The cartridge B is provided on its side surface with a charging input electrical contact 141a. In this embodiment, the developing unit 119 is provided on the side surface with the contact 160a which is a part of the development input electrical contact member 160 for applying the developing bias voltage to the developing roller 110. The development input electrical contact member 160 is electrically connected with a developing roller 110 (unshown) in the developing unit 119.

The drum frame 118 has an operation member 142 which is rotatably mounted to the drum frame 118. Structure of the operation member 142 is similar to that of Embodiment 1.

Figure 40, (a) and (b) show a state in which the operation member 142 rotates in the direction of an arrow an and in the direction of an arrow b.

As shown in Figure 40, (a), when the

operation member 142 is positioned after being rotated in the direction of an arrow a, the charging input electrical contact 141a and the development input electrical contact 160a are covered by the operation member 142. As shown in Figure 40, (b), when the operation member 142 rotates in the direction of an arrow b, the charging input electrical contact 141a and the development input electrical contact 160a are exposed.

That is, when the cartridge B is not mounted into the main assembly A of the apparatus, the operation member 142 is as in the state shown in Figure 40, (a). In other words, the charging input electrical contact 141a and the development input electrical contact 160a are covered by the operation member 142. The contacts are protected in this manner.

(2) Charging Output Contact and Development Output Contact

Referring to Figure 41, the description will be made as to the main assembly A of the apparatus to which the cartridge B is mountable.

Similarly to Embodiment 1, the side surface 145e of the inner side plate 145 of the main assembly A of the apparatus is provided with a charging output contact 144a for applying a charging bias voltage by contact with the charging input electrical contact

141a of the cartridge B. In this embodiment, also provided is the development output contact 161a for applying the developing bias voltage by contact with the development input electrical contact 160a.

In this embodiment, the structures and functions of the fixed engagcable member 146 and the displaceable member 147 are similar to those of Embodiment 1.

Namely, the displaceable member 147, as shown in Figure 41, moves in the direction of arrows c, d in interrelation with the mounting and demounting of the cartridge B. As shown in Figure 41, (b), when thc cartridge B is mounted into the main assembly A of the apparatus, the displaceable member 147 is pushed in the direction of an arrow c by the operation member 142 (Figure 40). In interrelation of the operation of the displaceable member 147, the charging output contact 144a and the development output contact 161a are projected through the openings 145a2 and 145a3 of the inner side plate 145, respectively. Then, they are brought into contact to the charging input electrical contact 141a and the development input electrical contact 160a, respectively.

(3) Movable Operation Member 142, Charging Output Contact Member 144 and Development Output Contact Member 161

The description will further be made as to

the operations of the operation member 142, the electrical contact member 144 and the electrical contact member 161.

Figure 42 - Figure s 44 are schematic vicws illustrating the operations of insertion of the cartridge B into the main assembly A of the apparatus.

Figure 42, (a), Figure 43, (a) and Figure 44, (a) are views of an inner side plate 145 of a main assembly A of the apparatus as seen from the inside (the views as seen in the direction of an arrow Y in Figure 41, (a)); Figure 42, (b), Figure 43, (b) and Figure 44, (b) are views as seen in the direction of an arrow Z in Figure 42, (a), Figure 43, (a) and Figure 44, (a).

Figure 42 illustrates a state in the process of insertion of the cartridge B into the main assembly A of the apparatus; Figure 43 illustrates a state in which the cartridge B is further inserted from the position shown in Figure 42; Figure 44 illustrates a state in which the cartridge B is further inserted and is completely mounted to the main assembly A of the apparatus.

As shown in these Figure s, a displaceable member 147 is mounted on an outside of an inner side plate 145 for rotation about a shaft portion 147a. A contact member 144 and contact member 161 are mounted on a supporting member 148. The supporting member 148

is mounted on the inner side plate 145 for sliding motion in the directions of arrows e, h. The supporting member 148 is urged in the direction of an arrow e by a compression spring 149 functioning as an elastic function member.

The displaceable member 147 and the supporting member 148 are abutted to each other at the respective abutting portions 147b and 148b and are interrelated with each other.

When the supporting member 148 is urged in the direction of an arrow e, the displaceable member 147 rotates in the direction of an arrow f. Then, the abutting portion 147d abuts the edge of the opening 145a1 of the inner side plate 145. Thus, the displaceable member 147 is positioned in place. At this time, the contact 144a is in a retracted position where the contact 144a is not projected into the inside of the main assembly A of the apparatus through the opening 145a2 formed in the inner side plate 145.

Similarly to Embodiment 1, the first engaging portion 142f of the operation member 142 is brought into contact with the contact portion 146a of the fixed engageable member 146 by the mounting operation of the cartridge B into the main assembly A of the apparatus, too, in this embodiment. This rotates the operation member 142 in the direction of an arrow k. Then, the charging input electrical contact 141a and

the development input electrical contact 160a are exposed. And, the operation member 142 rotates the displaceable member 147 in the direction of an arrow g. This moves the supporting member 148 in the direction of an arrow h. Thus, the contacts 144a, 161a are projected out of the inner side plate 145. And, the contacts 144a, 161a are contacted to the contacts 141a, 160a. A charging bias voltage and a developing bias voltage can now be applied from the main assembly A of the apparatus to the charging roller 108 and to the developing roller 110, respectively.

According to this embodiment, the charging input electrical contact 141a and the development input electrical contact 160a are covered by the operation member 142. Therefore, the electrical contacts 141a, 160a are protected from contact by the operator, when the operator handles the cartridge B. In this manner, the probability of the conduction defect which may otherwise be caused by the sweat, grease or the like can be reduced.

In the foregoing description of this embodiment, the operation member 142 covers the electrical contacts 141a, 160a in the stand-by state or position. However, the present invention is not limited to such a structure. For example, as has been described with respect to Embodiments 4 and 5, a

surface or surfaces higher than the contacts 141a, 160a may be provided on the operation member 142. By doing so, hard-to-touch electrical contact structure is provided.

In this embodiment, the advantageous effects of the first embodiment are provided.

Embodiment 8

Referring to Figure 45 - Figure 48, the description will be made as to an eighth embodiment.

In Embodiment 3, a charging input electrical contact 141a is provided so as not to project beyond the surface of the drum frame 118g adjacent a longitudinal end at a leading side with respect to the mounting direction in which the cartridge B is mounted to the main assembly A of the apparatus.

In this embodiment, the side surface of the cartridge B is provided with a development input electrical contact 160a.

In this embodiment, the structure of the cartridge B and the image forming apparatus 100 are similar to those of Embodiment 1 which has been described in conjunction with Figure s 1 and 2. The same reference numerals as with the foregoing embodiments are assigned to the elements having the corresponding functions, and the detailed descriptions for such elements are omitted for simplicity.

(1) Movable Operation Member of Cartridge B

Figure 45 show a cartridge B according to an eighth embodiment of the present invention.

In this embodiment, a charging input electrical contact 141a is provided adjacent a longitudinal end at a leading side with respect to the mounting direction in which the cartridge B is mounted to the main assembly A of the apparatus. The charging input electrical contact member 141 has a charging input electrical contact 141a adjacent the corner portion thereof. A first movable operation member 142A is mounted on the drum frame 118 with the supporting and positioning structures which are similarly to Embodiment 2.

On the other hand, the side surface of the cartridge B is provided with a development input electrical contact 160a for applying a developing bias voltage to the developing roller 110. The development input electrical contact member 160 is electrically connected with the developing roller 110 in the cartridge.

According to this embodiment, a second movable operation member 142B is mounted for rotation about the shaft portion 139 adjacent the development input electrical contact 160a. The operation member 142B is disposed outside, with respect to the longitudinal direction, guide portions 118k and 118m

for guiding the cartridge B which is being inserted into the main assembly A of the apparatus. The operation member 142B is mounted in the structures similar to the operation member 142 of Embodiment 1. The operation member 142B is urged in the direction of an arrow p by a coil spring 143 functioning as an elastic function member.

As shown in Figure 45, (a), the operation member 142A rotates in the direction of the arrow a, and the operation member 142B rotates in the direction of an arrow p and is positioned, and in this state, the contact 141a and the contact 160a are covered by the operation member 142A and the operation member 142B, respectively.

As shown in Figure 45, (b), when the operation member 142A rotates in the direction of an arrow b, and the operation member 142B rotates in the direction of an arrow m, the contact 141a and the contact 160a are exposed. In order to, when the cartridge B is not mounted in the main assembly A of the apparatus, the operation member 142A and the operation member 142B are in the state as shown in Figure 45, (a). In this state, the contact 141a and the contact 160a are protected by being covered by the operation member 142A and the operation member 142B, respectively.

(2) Charging Output Contact 144a and Development

Output Contact 161a in Main Assembly An of Apparatus

Referring to Figure 46 and 47, the description will be made as to the main assembly A of the apparatus into which the cartridge B is mountable.

Figure 46, (a) and Figure 47, (a) are perspective views of the inside of the main assembly B of the image forming apparatus. Figure 46, (b) and Figure 47, (b) are views as seen in the direction of an arrow W in Figure 46, (a) and Figure 47, (a).

Similarly to Embodiment 2, the main assembly A of the apparatus is provided with a charging output contact member 144. The first fixed engageable member 146A and the first displaceable member 147A are mounted in the same structures in Embodiment 2.

The displaceable member 147 A moves in the directions of arrows c, d in interrelation with mounting and demounting of the cartridge B. As shown in Figure 47, (b), when the cartridge B is inserted into the main assembly A of the apparatus, the displaceable member 147A is pushed by the operation member 142A (Figure 45) and is rotated in the direction of the arrow c. By this, the charging output contact 144a is projected out of the cover portion 171 and is brought into contact with the charging input electrical contact 141a.

The inner side surface of the main assembly A of the apparatus is provided with a development output

contact 161a for applying the developing bias voltage through contact with the development input electrical contact 160a.

When the cartridge B is not mounted in the main assembly A of the apparatus, the contact 161a is kept at a position where it does not projects through the opening rib 145a2 formed in the inner side plate 145. Between the inner side plate 145 and the main assembly guides 130L1, 130L2 (outside the main assembly guides 130L1 and 130L2 and inside of the inner side plate 145), a second fixed engageable member 146B which is an abutting portion for rotating the operation member 142B in interrelation with mounting of the cartridge B. An one end portion 147c of the second displaceable member 147B is projected downstream of the fixed engageable member 146B with respect to the mounting direction of the cartridge B.

The displaceable member 147 B moves in the directions of arrows n, o in interrelation with mounting and demounting of the cartridge B.

As shown in Figure 47, when the cartridge B is mounted in the main assembly A of the apparatus, the displaceable member 147B is pushed in the direction of the arrow o by the operation member 142B (Figure 45) of the cartridge B. By this, the contact 161a is projected through an opening rib 145a2 provided on the inner side plate 145 in interrelation

with the operation of the displaccable member 147B. And, the contact 161a is brought into contact with the developing device contact 160a.

The displaceable member 147B and the contact member 161 are mounted in the same manner as with Embodiment 1. Namely, the displaceable member 147B is mounted on an outside of the inner side plate 145 and is rotatable about the center of the shaft portion 147a. The contact member 161 is mounted on the supporting member 148. The supporting member 148 is mounted for rotation about the shaft portion 148a. The supporting member 148 is urged in the direction of an arrow e by a compression spring 149 functioning as an elastic function member. The displaceable member 147 B and the supporting member 148 are abutted to each other at the respective abutting portions 147b and 148b, and are interrelated with each other.

When the supporting member 148 is urged in the direction of an arrow e, the displaceable member 147 B rotates in the direction of an arrow f. It is positioning in place by the abutting portion 147c abutting the edge of the opening 145a1 formed in the inner side plate 145. At this time, the contact 161a is placed in a retracted position where it does not project into the main assembly A of the apparatus through the opening rib 145a2 formed in the inner side plate 145.

(3) Movable Operation Member, Charging Output Contact Member and Development Output Contact Member

The description will be made as to the operations of the operation member 142A, the operation member 142B, the charging output contact member 144 and the development output contact member 161.

Figure 48 is a schematic view illustrating the operation when the cartridge B is inserted into the main assembly A of the apparatus.

Figure 48 is a view of the inner side plate 145 as seen from an inside of the main assembly of the apparatus (as seen in the direction of the arrow Y in Figure 46, (a)); Figure 48 (a) illustrates a state in the process of insertion of the cartridge B into the main assembly A of the apparatus; Figure 48, (b) is a view in which the cartridge B has been mounted in place in the main assembly A of the apparatus.

As shown in these Figure s, the displaceable member 147A and the contact member 144 are positioned and supported in the similar manner as with Embodiment 2. That is, by the rotation of the displaceable member 147A, contact 144a is movable between an electrical connecting position where it projects through the cover portion 171 and a retracted position where it does not.

Similarly to Embodiment 2, the first engaging portion 142f of the operation member 142A is brought

into contact with the first fixed engageable member 146A by the mounting operation of the cartridge B into the main assembly A of the apparatus. This rotates the operation member 142 An in the direction of an arrow k. And, the charging input electrical contact 141a is exposed. The operation member 142A rotates the displaceable member 147A in the dirccction of the arrow c. By this, the charging output contact 144a is projected from the cover portion 171. By doing so, the charging output contact 144a is contacted by the charging input electrical contact 141a of the cartridge B. Therefore, the charging roller 108 can now be supplied with the charging bias voltage from the main assembly A of the apparatus.

The operation member 142B and the contact member 161 are operated with the same structure as the operation member 142 and the contact member 144 of Embodiment 1.

Namely, by the operation of mounting the cartridge B into the main assembly A of the apparatus, the first engaging portion 142f of the operation member 142B is contacted to the second fixed engageable member 146B. This rotates the operation member 142 B in the direction of an arrow m. By this, the development input electrical contact 160a (the backside surface of the development input electrical contact member 160 in Figure 48) is exposed.

And, the operation member 142B pushes the abutting portion 147c of the displaceable member 147B in the direction of an arrow o. This rotates the supporting member 148. Then, the contact 161a is projected through the opening rib 145a2 of the inner side plate 145. This causes the contact 161a to contact to the contact 160a. Therefore, the developing bias voltage is now applicable to the developing roller 110 from the main assembly A of the apparatus.

According to this embodiment, the charging input electrical contact 141a and the development input electrical contact 160a are covered by the operation members 142 An and 142B. Therefore, the electrical contacts 141a, 160a are protected from contact by the operator, when the operator handles the cartridge B. In this manner, the probability of the conduction defect which may otherwise be caused by the sweat, grease or the like, can be reduced.

In the description of this embodiment, the operation members 142A, 142B cover the electrical contacts 141a, 160a, respectively in the stand-by states or positions. However, the present invention is not limited to such a structure. For example, as has been described with respect to Embodiments 4, 5 and 6, a surface or surfaces higher than the contacts 141a, 160a may be provided on the operation member

142. By doing so, hard-to-touch electrical contact structure is provided.

In this embodiment, the advantageous effects of the first and second embodiments are provided.

Embodiment 9

Referring to Figure 49 - Figure 53, the description will be made as to a ninth embodiment.

The same reference numerals as with the foregoing embodiments are assigned to the elements having the corresponding functions, and the detailed descriptions for such elements are omitted for simplicity.

The embodiment is different from Embodiment 1 in that when the cartridge B is not mounted in the main assembly A of the apparatus, the voltage source S and the output contact 144a are not electrically connected with each other. Therefore, the voltage from the voltage source S is not applied to the output contact 144a.

Figure 49 illustrates a structure of the movable operation member 142 and the charging input electrical contact member 141 which are mounted on the cartridge B.

As shown in Figure 49, a side of the drum unit 120 is provided with a movable operation member 142 and an input electrical contact member 141 which

are mounted in the structure similar to Embodiment 1 (Figure 8, 9). However, although the charging input electrical contact 141a of the input electrical contact member 141 is parallel with the side surface 120b1 of the cartridge B in Embodiment 1, it is inclined downward in the present embodiment.

The description will be made as to the charging output contact member 144 provided in the main assembly A of the apparatus.

As shown in Figure 50, (a) and (b), on an inside side plate 145 of the main assembly A of the apparatus is provided with a charging output contact member (output contact member), contacted to the input electrical contact 141a, for applying a charging voltage to the input electrical contact 141a. The side plate 145 is mounted on an inside of an outer plate 184 constituting a frame of the main assembly A of the apparatus. The outer plate 184 is covered by an outer casing C (Figure 3).

The output contact member 144 is constituted by wire. An output contact 144a which is a part thereof is contacted with the input electrical contact 141a. Here, the contact member 144 has a channel-like shape, and a corner portion thereof functions as the electrical contact 144a. When the cartridge B is not mounted in the main assembly A of the apparatus, the electrical contact 144a is placed in a position

between the perpendicular plates 145f provided on an inner side surface 145e of the side plate 145 (Figure 50, (a)). The side plate 145 is provided with a fixed engageable member 146 and a displaceable member 147 having at an end thereof a displaceable engaging portion 147c in the similar structure as in Embodiment 1. In other words, the perpendicular plates 145f are juxtaposed with a clearance therebetween and are extended perpendicular to the side plate 145. The electrical contact member 141 is disposed between them. Therefore, the hand of the operator or a tool or the like is not easily contactable to the contact member 144 when the operator carries out the maintenance operation for the main assembly of the apparatus. This is because the hand or the like is prevented by the perpendicular plates 145f from entering between the perpendicular plates 145f.

The displaceable member 147 c moves in the directions of arrows c, d in interrelation with mounting and demounting of the cartridge B. When the cartridge B is inserted into the main assembly A of the apparatus, the displaceable engaging portion 147c is brought into contact with the operation member 142, and is pushed in the direction of an arrow c by the movement of the cartridge B in the mounting direction X (inserting direction). In interrelation with the movement of the displaceable engaging portion 147c,

the displaceable member 147 moves. In interrelation with the operation of the displaceable member 147, the output contact 144a is projected upwardly from the perpendicular plate 145f. And, the output contact 144a is contacted with the input electrical contact 141a (Figure 50, (b)).

Referring to Figure 51 - Figure 53, the description will be made as to the structure of the displaceable member 147 and the output contact member 144.

Figure 51 is views of the displaceable member 147 and the output contact member 144 as seen from the outside of the outer plate 184. Figure 52, (a) and (b) illustrate a structure of a mounting portion of the output contact member 144.

As shown in these Figure s, the outer plate 184 has holes 184c, 184d, 184e formed therein. Through the hole 184c, a mounting portion 145b provided on the side plate 145 is projected outward. Similarly, through the hole 184d, a mounting portion 145j provided on the side plate 145 is projected outward. Similarly, through the hole 184 e, a mounting portion 145 g provided on the side plate 145 is projected outward.

Similar to Embodiment 1, the displaceable member 147 is mounted for rotation about a shaft portion 147a mounted on the outside of the side plate

145.One end of the shaft portion 147a is mounted on the mounting portion 145j. The other end of the shaft portion 147a i is mounted on the mounting portion 184b. The mounting portion 184b is extended outward from the outer plate 184.

A lever 181 is mounted for rotation about the shaft portion 181a. One end of the shaft portion 181a is mounted on the mounting portion 145b. The other end of the shaft portion 181a is mounted on the mounting portion 184a. The mounting portion 145b is provided on the side plate 145, and is projected outward through the hole 184c formed in the side plate 184. The mounting portion 184a is extended outward from the outer plate 184. The lever 181 is urged in the direction of an arrow e by an elastic function member (for example, a coil spring) 149. Therefore, by the elastic force of the elastic function member 149, the displaceable member 147 and the lever 181 are abutted to each other at the respective abutting portions 147b, 181b. Thus, the displaceable member 147 and the lever 181 are interrelated with each other.

In this embodiment, the lever 181 is provided with a main assembly electrical contact member 182. The main assembly electrical contact member 182 is electrically connected to an electric circuit (voltage source circuit) E of the circuit board EC provided in

the main assembly A of the apparatus through lead lines or the like. The main assembly electrical contact member 182 is electrically contacted and connected with the output contact member 144 by the operation of the lever 181.

The output contact member 144 is mounted on the supporting member 180. The supporting member 180 is mounted on the mounting portion 145g of the side plate 145 for rotation about the shaft portions 180a, 180b (co-axial with each other).

The output contact member 144 comprises a coil spring having an arm portion 144e which is provided with an output contact 144a and a second electrical contact 144b. The electrical contact member 144 is mounted on the shaft portion 180a of the supporting member 180.

To the shaft portion 180b of the supporting member 180, a coil spring 183 is mounted. The spring 183 is locked with a locking portion 180c of the supporting member 180 at the arm portion 183a. The arm portion 183b of the spring 183 is locked with a locking portion 145h of the side plate 145 (Figure 52, (a)). By doing so, the spring 183 urges the supporting member 180 in the direction of an arrow r. At this time, the projection 180d of the supporting member 180 is abuted to an abutting portion (unshown) which is provided inside the side plate 145. Thus,

the position of the supporting member 180 with respect to the rotational direction is determined (the retracted position shown in Figure 50, (a) and Figure 53, (c), where the electrical contact 144a is retracted in the inside of the perpendicular plates 145f).

In Figure 52, (a) and (b), the supporting member 180 is removed from the mounting portion 145g for better understanding.

Figure 53, (a) and (b) show states in which the cartridge B is mounted in place in the main assembly A of the apparatus. Figure 53, (b) and Figure 53, (a) are views as seen in the direction of an arrow V. For better understanding, again, in Figure 53, (a), the side plate 145 and the outer plate 184 are omitted. In Figure 53 (b), the side plate 145 is indicated by broken lines. Figure 53, (c) shows a state in which the cartridge B is not mounted (same as with Figure 50, (a)).

When the cartridge B is inserted into the main assembly A of the mounting, the movable operation member 142 is brought into contact with the fixed engageable member 146. By this, the movable operation member 142, similarly to Embodiment 1 (Figure 10, (b)), is rotated in the direction of an indicated by the arrow b about the drum shaft 139. Thus, it is moved from the position and covering the electrical contact

141a. This exposes the input electrical contact 141a. Then, the movable operation member 142 is brought into contact with the displaceable engaging portion 147c. With further insertion of the cartridge B, the displaceable member 147 is rotated in the direction of the arrow g. This is similar to Embodiment 1 (Figure 13, (a), Figure 14, (a) and Figure 15, (a)).

The displaceable member 147 is rotated in the direction of the arrow g. In interrelation with the rotation of the displaceable member 147, the lever 181 is rotated in the direction of the arrow h (Figure 53, (a)). This moves the main assembly electrical contact member 182 mounted on the lever 181 from the position shown in Figure 53, (c) to a position shown in Figure 53, (b). Then, the main assembly electrical contact member 182 is contacted to the supporting member 180. This rotates the supporting member 180 in the direction of an arrow u. Then, the output contact 144a mounted on the supporting member 180 is projected upward to an output contact 144a from between the perpendicular plates 145f. The electrical contact 144a is brought into contact with the input electrical contact 141a of the cartridge B which is now in the mounting portion 130a. At this time, the main assembly electrical contact 182a of the main assembly electrical contact member 182 and the second contact 144b of the output contact member 144 are contacted

with each other and therefore are electrically connection with each other. By this, a voltage from the voltage source S (Figure 16) is applicable to the charging roller 108 through the main assembly contact member 182, the main assembly electrical contact 182a, the output contact member 144 and the input electrical contact member 141. When the cartridge B is not mounted in the main assembly A of the apparatus, the main assembly electrical contact 182a and the second contact 144b of the output contact member 144 are disengaged from each other. Therefore, the voltage from the voltage source S is not applied to the output contact 144a. Accordingly, even if the operator inadvertently touches the output contact member 144 and/or output contact 144a in the maintenance operation or the like, the electric circuit E is not damaged.

This embodiment also provides the advantageous effects similar to Embodiment 1.

While the invention has been described with reference to the structures disclosed herein, it is not confined to the details set forth and this application is intended to cover such modifications or changes as may come within the purpose of the improvements or the scope of the following claims.